CHAPTER VI
DESCRIPTION OF THE RECOMMENDED PLAN

6.1 THE RECOMMENDED PLAN

Based on the results of the analyses conducted and described in Chapter V above, Alternative 5A has been identified as the recommended NER Plan. Alternative 5A is shown in plates at the end of the report.

6.2 PLAN FEATURES

The Recommended Plan (Alternative 5A) includes restoration of four significant habitat types throughout the project area. These are habitats that are scarce and ecologically significant in the desert southwest, including cottonwood/willow (375 acres), mesquite (417), wetlands including within the river channel (190 acres), and restoration of 8 miles of river channel made up of approximately 500 acres of active channel and riparian scrub. Multiple measures make up the restoration plan, including, water supply and distribution, channel restoration, revegetation, and invasive-species removal.

6.2.1 River Channel Restoration

Restoring the river channel to a more natural state would be accomplished by grading and terracing to help restore an active channel through the entire 8-mile reach. Average depth would be 5 feet, with a width varying from 200 to 400 feet. The channel design passes a 5-year event (~22,000 cfs) with occasional flooding on the terrace 2 to 4 feet depth at 1-7 cfs. An estimated 660,000 c.y. would be removed from the channel to implement this measure. Material removed would be native riverbed material and would be used on site for terracing and construction of other project components, such as reshaping of the two "lakes" within the project area.

Grade Control Structure. Due to a drop in grade downstream of the 35th Avenue Bridge, a grade-control structure is recommended within that vicinity. This structure would be similar to those installed in the upstream Rio Salado Project, and would consist of roller-compacted concrete and grouted stone.

would be less, with approximately 25 velvet mesquite, 5 screwbean mesquite, and 10 understory shrubs per acre.

Riparian Scrub: It is assumed that some portions maintained will remain a more xeric desert scrub but others adjacent to the wetter riparian habitats will develop into more distinctive riparian cover containing species such as Seepwillow, desert broom, or Desert willow. Approximately 296 acres of the active river channel will be riparian scrub.

6.2.4 Wetlands

A total of approximately 156 acres of wetlands would be restored with Alternative 5A. This would include the stormwater wetlands described above, in the vicinity of the "lakes," and within the restored channel. Wetlands could consist of open water, submerged vegetation, or mud flats, all requiring a high water table at or near the surface. Due to the porous soils found in this project area, lining the site would be required to maintain surface water. Excavation and layering of a silt-clay soil substrate overlain by a mixed gravel, and finally, cobble layer, is recommended. This soil structure would reduce disturbance of the soil-clay layer by reducing piping of fine material and reducing turbulent forces acting on the layer. Emergent wetlands contain primarily cattails (*Typha domingensis*), tule (*Scirpus acutus*), and sedges (Carex spp.). Because the river will not flow year round, the wetlands would need to be constructed specifically to retain water. In addition to grading and excavation, an impermeable layer would be added to retain water on site.

6.2.5 Lake Restoration

There are existing lake features created from aggregate mining operations at 27th and 37th Avenues that would require modification to implement lake restoration. Under Alternative 5A, the proposed measures include significant regrading to restore the lake features into a more natural state coinciding with the floodplain environment. This would include the movement of approximately 3 million c.y. of materials. With the reshaping of the two areas, additional measures described above would be incorporated, including the wetland and riparian habitat restoration that would be carried out within them.

River Channel Habitats: The habitats restored within the active channel will include a combination of dry river bottom, emergent wetland, riparian scrub or desert scrub, depending on the specific site. Total acreage of the active river channel is assumed to be nearly 500 acres comprised of a 170 acre low flow channel, 34 acres of emergent wetland and the remainder riparian scrub.

6.2.2 Stormwater Wetlands

Stormwater outfalls within the project area have been identified and average discharges from them quantified, with an estimated 2,863 ac-ft available for use in restoration. This measure includes the addition of grouted rock channels extending from the banks into the channel from existing pipe outfalls. The grouted rock would extend approximately 100 feet from the existing pipe outfall and would vary from 2 to 4 feet in height. The required grout is approximately thirty percent of the needed rock. Each outfall would require 221 c.y. of rock and 67 c.y. of grout. The outfall sites would require a total of 1989 c.y. of rock and 603 c.y. of grout. Large storm flows would be conveyed to the channel while smaller discharges would be directed into adjacent wetland and riparian habitat areas. Techniques would be site-specific and would include grading or excavation, removal of exotics, and planting of suitable vegetation for the site conditions. Supplemental water would be required via an irrigation source, and structures would be installed to contain high-energy inputs and avoid erosion during storm events. It was assumed that approximatley 28 acres of wetlands would be associated with the outfalls within the study area and that they will improve the water quality.

New Stormwater Outfalls: As the land to the west of 51st Avenue is developed, additional stormwater runoff to the river would be possible. At 75th Avenue, a future storm drain may provide additional source water for project features. However, current drainage regulations require onsite retention of runoff. Changes to local zoning regulations and implementation of stormwater drainage plans for lands nearby the river could provide the benefit of additional project water, increased habitat values, and management of stormwater quality and quantity as the area is devleoped.

6.2.3 Revegetation

Planting of riparian vegetation to restore the various cover types is included in the plan. General locations of the restored habitats are shown on Plates at the end of the report.

Cottonwood/Willow: Cottonwood/willow would be dominated by Fremont's cottonwood (*Populus fremontii*) and Gooding's willow (*Salix gooddingii*). Other understory species would be planted, depending upon individual site conditions, but may include arrowweed (*Pluchea sericea*), elderberry (*Sambucus mexicana*) or burrobush (*Hymenoclea spp*.). The feasibility design includes approximately 60 to 100 trees and 5 shrubs per acre, with a combination of pole and containerized plantings. Hydroseeding of ground cover and additional shrubs is also included in the design.

Mesquite: This habitat would be restored over a potentially large portion of the project area. It would require periodic watering for the first five years after planting, though with less frequency than cottonwood/willow. Watering could possibly be discontinued after five years or when roots are expected to reach groundwater. Mesquite bosques would be dominated by velvet mesquite (*Prosopis velutina*), with scattered screwbean mesquite, and some understory shrubs, such as desert thorn (Lycium spp.), palo verde (*Cercidium floridum*), brittlebush (*Encelia farinose*), and forbs.

Bosque: Mesquite bosques are commonly found 5 to 20 feet above the river channel where water is adequate. They require a water table or semi-saturated soil conditions 10 to 30 feet below the surface elevation, and rely on occasional saturated conditions 1 to 3 feet below the surface. Soil requirements range from fine to gravelly with some rocky areas. The mesquite bosques would be planted with a density of approximately 100 velvet mesquite, 10 screwbean mesquite, and 40 understory shrubs per acre. Understory forbs would also be planted using a seed mix.

Xeric: In locations throughout the study with less water supply, xeric stands of mesquite would be established. It is assumed that mesquite would survive under drier conditions and on higher terraces than mesquite bosques. Planting densities

6.2.6 Invasive Species Management

Invasive species such as saltcedar and Arundo would require removal and management with project implementation. This would likely require physical removal and ongoing maintenance through the life of the project. Saltcedar is currently found in stands throughout the study area. Arundo, although not yet a significant problem in Arizona, is a problem in neighboring California and some stands are found within the project area. It was assumed that an approximate 120 acres would require invasive-species control measures prior to restoration.

6.2.7 Water Supply and Distribution

The City of Phoenix developed the water supply and distribution plan for the project. The primary water supply for the Rio Salado Oeste project would be effluent obtained directly from the 23rd Avenue WWTP with supplemental water (if necessary) potentially from several sources. An estimated 8 mgd is available from the 23rd Avenue Plant.

The sustainable water supply and distribution system would consist of the following features:

- 20 mgd pump station
- Supply well
- Monitoring wells
- Electronic flow regulated valves
- Reservoirs
- Pump stations
- Open channel canals
- Irrigation system
- Pressurized distribution piping

A combination of irrigation approaches could be implemented in the project and would be determined in detail during design. These could include temporary drip systems for establishment of vegetation, subsurface liners to create an artificially perched aquifer, and canal or rill (ditch or flood) irrigation, as well as water-harvesting polymer, or polymer-type products, planted with vegetation. The estimated cost of the water supply and distribution for the recommended alternative is $22,037,500.

6.3 PROJECT OUTPUTS

The recommended plan provides a habitat value of 847 AAFCUs, or a net increase of 267 AAFCUs over without-project conditions. This is a 46 percent increase in AAFCUs with project implementation.

In addition, the restoration included in this project would provide an important and significant linkage between the other restoration projects on the river. Restoration of this 8-mile reach would tie together Rio Salado upstream and Tres Rios downstream, providing approximately 21 miles of contiguous Sonoran desert riparian habitat. This type of river-connected riparian and fringe habitat is of an extremely high value due to its rarity. Arid southwest riparian ecosystems are recognized as a critically endangered habitat type. It has been estimated that 75 to 90 percent of all wildlife in the arid southwest is riparian-dependent during some part of its life cycle.

Table VI-1 Alternative 5A Cost Estimate

Estimate MCACES Cost Estimate ($1,000s FY 06 PL 5 1/8%)	
Construction	$66,343
Contingency (20%)	$13,269
Subtotal	$79,612
PED/EDC (11%)	$8,757
Subtotal	$88,369
S&A (6.5%)	$5,744
Total Construction Cost	$94,113
Real Estate (including 25% contingency)	$55,900
Subtotal	$150,013
Monitoring and Adaptive Management	$3,765
Total First Cost	**$153,776**
IDC	$15,770
Gross Investment	$169,547
Annualized Investment Cost	$9,467
Associated Cost (water supply)	$817
O&M	$2,083
Total Annual Cost	**$12,367**

Notes: *EDC= Engineering During construction*
S&A= Supervision and Administration

6.4 MAINTENANCE CONSIDERATIONS

O&M activities would occur after project construction in order for project features to function as designed. O&M activities are detailed within the cost estimate and would include the activities listed below.

Replacement Costs. Up to 25 percent of vegetation could require replacement following a flood event at some time during the project life.

Invasive Species Control. Annual removal of exotic species was assumed to be necessary. This would include removal of non-native species that threaten to overtake an area and become a monoculture. This wouldn't necessarily include removal of 100 percent of non-natives through the project area.

Stormwater Wetlands. Regrading and excavation was assumed to be necessary once every 10 years. It was assumed that 50 percent of the construction quantity would need to be regraded in this period.

Irrigation System. Maintenance of the irrigation infrastructure, including replacement of infrastructure, would occur annually. Costs were estimated on a per-acre basis for those acres planted to vegetation.

Lakes/Wetlands. The restored wetlands at existing lakes (gravel pits) would require regrading and excavation once every 20 years of up to 1 foot of material over the 40 acres of wetlands.

Channel. The active channel would require regrading up to once every 20 years for up to 50 percent of the estimated construction quantity or 330,000 c.y.

Water Supply. The water supply and distribution system would require periodic maintenance and inspection of pumps and pipelines. Inspection, repair, and replacement would be necessary for the irrigation system and infrastructure. More detailed description of maintenance is included in Appendix J, Design and Cost Estimate.

6.5 RECREATION PLAN

The City of Phoenix developed the recreation plan for the project, which may be found in Appendix L. The plan is consistent with Corps policy on development of recreation at ecosystem restoration projects, as outlined in Policy Guidance Letter No. 59, USACE 1998. Major recreation features include multipurpose trails, shelters, signage, utilities, park furniture, and interpretive media. Access points are identified in the plan, with four drive-in points with parking facilities and five smaller access points for walk-in use. Although an environmental-education center is included in the local plan, it is not a cost-shareable portion of the project and would be a local sponsor cost. Table VI-2 below summarizes the locations and features included in the recreation plan.

Table VI-2 Recreation Plan

Component	Quantity	Unit Cost	Recreation Cost
Site Preparation			
Site Prep to include: clearing, grubbing, and grading	9	Lump Sum	$250,000.00
Vegetative Restoration (Drive in Access)	4	Lump Sum	$600,000.00
Vegetative Restoration (Walk in Access)	5	Lump Sum	$75,000.00
Access and Circulation			
Entry Road w/Turnaround to include: curb, gutter, driveway, & road	4	Lump Sum	$600,000.00
Parking lot	500	$1500/space	$750,000.00
Sidewalks and Ramps	40,000 sf.	$6.00 each	$240,000.00
Multi-Use Trails (24mi * 5280 * 5ft)	47000	$6.00 / sy	$282,000.00
Bridges and Culverts (small) @ Canals, and Localized Drainage Areas	10	$7,500 each	$75,000.00
Protection Access Control			
Access Control Gates (vehicular)	10	$7,500 each	$75,000.00
Access Control Gates (pedestrian)	18	$3,500 each	$63,000.00
Handrails	5,000 l.f.	$50.00 each	$250,000.00
Guardrails	3,000 l.f.	$50.00 each	$150,000.00
Fencing	5,000 l.f.	$30.00 each	$150,000.00
Walls	1,500 l.f.	$125.00 each	$187,500.00
Security lights	100	$4,000 each	$400,000.00
Signage			
Entrance identification signage	8	$15,000 each	$120,000.00
Traffic Control (vehicular)	20	$500 each	$10,000.00
Traffic Control (pedestrian)	27	$500 each	$13,500.00

Instructional/Directional	45	$500 each	$22,500.00
Shelters			
Picnic (large)	5	$60,000 each	$300,000.00
Picnic (small)	5	$25,000 each	$125,000.00
Restroom Facility/Comfort Station	5	$250,000 each	$1,250,000.00
Shelter w/Bulletin Boards	4	$25,000 each	$100,000.00
Trail Shelter w/Railing (large)	9	$40,000 each	$360,000.00
Trail Shelter w/Railing (medium)	4	$30,000 each	$120,000.00
Trail Shelter w/Railing (small)	10	$20,000 each	$200,000.00
Utilities			
Municipal Water Supply and Wastewater Disposal	5	Lump Sum	$500,000.00
Storm Drainage	4	Lump Sum	$80,000.00
Drinking Fountain w/Chiller	12	$5,000 each	$60,000.00
Electical	4	Lump Sum	$200,000.00
Park Furniture			
Benches:	14	$1,500 each	$21,000.00
Off-the-Shelf	40	$800 each	$32,000.00
Recycled/Custom	50	$500 each	$25,000.00
Picnic Tables	40	$1000 each	$40,000.00
Trash Receptacles	75	$500 each	$37,500.00
Interpretive Guidance Media			
Display Boards	50	$600 each	$30,000.00
Interpretive Markers	100	$600 each	$60,000.00
Bulletin Boards	9	$2,500 each	$22,500.00
		Subtotal	**$7,876,500.00**
	Contingency	20%	$1,575,300
	PED+EDC	11%	$1,039,698
	S&A	7%	$681,947
		Total	**$11,173,445**

The recreation plan is estimated at $11,173,445, with Annual O&M of $800,000.

6.6 ASSOCIATED NON-FEDERAL CONSIDERATIONS

The non-Federal sponsor (Sponsor) for the project would be required to purchase all lands, easements, rights-of way and disposal areas (LERRDs) needed for project implementation. Real estate is described in more detail in Appendix H. Approximately 1,500 acres are required for the project and currently estimated at $55,900,000. The estate to implement this project is recommended as fee simple. However, lands owned by Maricopa County are recommended to

be acquired by permanent easement. The estate will be requested in accordance with ER-405-1-12, Chapter 12 Paragraph 12-9 c.

The cost of lands for this project is in excess of 25% of the total project cost. Corps policy pertaining to ecosystem restoration states that "As a target, land value should not exceed 25 percent of total project costs. Projects with land costs exceeding this target level are not likely to be given a high priority for budgetary purposes." (ER 1105-2-100; Section E-30.f).

The Sponsor would be responsible for remaining implementation costs required to bring the total non-Federal share to 35 percent of the total first cost of construction. The Sponsor would also be responsible for Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) costs (estimated at $2,083.000 per year). The sponsor would also be responsible for 50 percent of the cost to implement the selected recreation plan. Annual OMRR&R costs of $800,000 associated with the selected recreation plan would also be the Sponsor's responsibility.

6.7 MONITORING AND ADAPTIVE MANAGEMENT PLAN

The Salt River, although highly modified and controlled, remains a natural river system where changes may occur. While planning for this project has accounted for the possible factors affecting the study area, it is inevitable that uncertainty would remain with the outcome of the recommended plan. Implementation of a monitoring and adaptive management plan would not alleviate all uncertainty, but would provide flexibility to account for changing environmental conditions and new information, as well as measure project success.

The Monitoring and Adaptive Management Plan is an essential element for the overall implementation of the proposed plan. It would provide a mechanism to evaluate the effectiveness of the restoration measures implemented in this project and to implement adaptive changes, if required, to realize project objectives. As described in ER 1105-2-100 Planning Guidance Notebook page 3-25 (8) Monitoring and adaptive management:

> "Monitoring may be necessary to determine if the predicted outputs are being achieved and to provide feed back for future projects … The cost of monitoring included in the total project cost and cost shared with the non-Federal sponsor shall not exceed one percent of the total first cost of ecosystem restoration features. For complex specifically

> authorized projects that have high levels of risk and uncertainty of obtaining the proposed outputs, adaptive management may be recommended. The cost of the adaptive management action, if needed, will be limited to 3 percent of the total project cost excluding monitoring costs."

It was assumed that the Monitoring and Adaptive Management Plan for the recommended plan would be 4 percent of total construction, or $3.75 million over five years. The plan includes cost-shared monitoring and adaptive management actions during the first five years after initial project implementation. After the first five years, monitoring and/or adaptive management would become the responsibility of the local sponsor (City of Phoenix). However, the local sponsor can use this plan to help guide the monitoring efforts and refine the project features such that project goals and objectives are achieved.

It is recommended that the plan, found in Appendix N (Monitoring and Adaptive Management) be reevaluated and updated during PED, taking into account lessons learned from the Rio Salado and Tres Rios Projects in the immediate vicinity, as well as other projects such as Va Shly'ay Akimel further upstream on the Salt River.